Ateis International
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IDA4 in switching application with the new IDA4SW 1.2.x

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I. Introduction

The combination of IDA4SW(s) and IDA4SU allows connecting up to 8 zones to the same amplifier.
The zone selection will then happen through the automatic switching of the relevant 100V speaker line to the corresponding 100V amplifier output.
Each line and amplifier will be constantly monitored according EN60849/BS5839 with no background music interruption.
In the ‘’Dual audio channel’’ mode, when a microphone or message call is made in a zone or group of zone, the music will not be interrupted in the zones not selected for the call.
In the ‘’Single audio channel’’ mode, in case of a selective call, the music will be interrupted only in the zones connected to the IDA4SU receiving the call.
Each IDA4SU, and the 8 zones connected to it, could receive a different music source to a predefined level.
In ‘’Single audio channel’’ mode, each IDA4SW(s) will be able to control up to 4 IDA4SU (32 zones) and a total of 4 IDA4SW(s) can be linked together allowing to build a 128 zones PA/VA system.
In ‘’Dual audio channel’’ mode, each IDA4SW(s) will be able to control up to 2 IDA4SU (16 zones) and a total of 8 IDA4SW(s) can be linked together allowing to build a 128 zones PA/VA system.
For both modes, the maximum audio power per IDA4SU, and the 8 zones connected to it, is 500W.
Those combinations are ideal for applications requesting a lot of zones like schools, high raise buildings, commercial buildings…

Disclaimer: in order to be EN60849/BS5839 compliant, your system must respect certain constraints on line impedance and end of line capacitors. Please read carefully the design rules presented in section III.

II. Wiring

The IDA4SW(s) hardware is the same as the IDA4(X)(M)(s) series.
100V line switching is performed through the use of one or several external IDA4SU units controlled by the new IDA4SW(s) firmware.

IDA4SW features 4 audio outputs called Channels + in/out connectors for amp and line monitoring.

IDA4SU was originally designed for A/B line monitoring. It features 4 in/out connectors for 0dB audio, amplifier and A/B lines, plus one 100 V music input. In switching application, we replicate the 100V amplified signal on the 4 inputs and use A/B lines independently for a total of 8.

Amp monitoring and backup remains the same as IDA4(X)(M)(s).
One 100V output is connected to the 4 inputs of one IDA4SU.
Loudspeakers lines are then connected on the 8 outputs of an IDA4SU unit.
IDA4SU control connection is made via a chainable RS232 serial link. (port 3)

Each IDA4SU can then address up to 8 zones with a single amplifier. Each zone output can be switched on its 100V input or on the global 100V music input.

In addition, IDA4SU can go in 'Bypass Mode' when it does not receive commands anymore, because the IDA4SW has crashed or the link is broken. This requires complete wiring to allow the unit to switch the PSS audio signal on the amplifier and all 100V lines.

a. Mono channel mode = Announcement only

We use only one IDA4SW(s) audio output and one amp for each IDA4SU.
100V music input is not connected.
So each zone can be switched on the common announce signal or off.

As IDASW features 4 audio outputs, you can connect up to 4 amplifiers + 4 IDA4SU, which enables monitoring and addressing up to 32 zones.

The single output on the 8 zones being the same, you can only play the same message on the zones of a same group.
But you can of course page different announces on each of the groups.

b. Dual channel mode = Announces + independent music

In this mode, we use 2 audio outputs and amplifiers for each IDA4SU: one for the announces and another for music.

So each zone can be switched on the announce signal or on the music.

With 4 amplifiers + 2 IDA4SU, you can monitor and address up to 16 zones with a single IDA4SW.

As for announce-only mode, the music is the same for all zones of a same group.
But you can of course choose different music sources or no music on each group.

ATEÏS
Intégrateur de Systèmes Audio

IDA4SW 1 CHANNEL WIRING DIAGRAM

0dB SIGNAL
100V SIGNAL
SERIAL LINK

IDA4SW

VOICE / MUSIC
ZONES 1 TO 8

VOICE / MUSIC
ZONES 9 TO 16

VOICE / MUSIC
ZONES 17 TO 24

VOICE / MUSIC
ZONES 25 TO 32

IDA4SU

IDA4SU

IDA4SU

IDA4SU

ZONE 1
ZONE 2
ZONE 3
ZONE 4
ZONE 5
ZONE 6
ZONE 7
ZONE 8
ZONE 9
ZONE 10
ZONE 11
ZONE 12
ZONE 13
ZONE 14
ZONE 15
ZONE 16
ZONE 17
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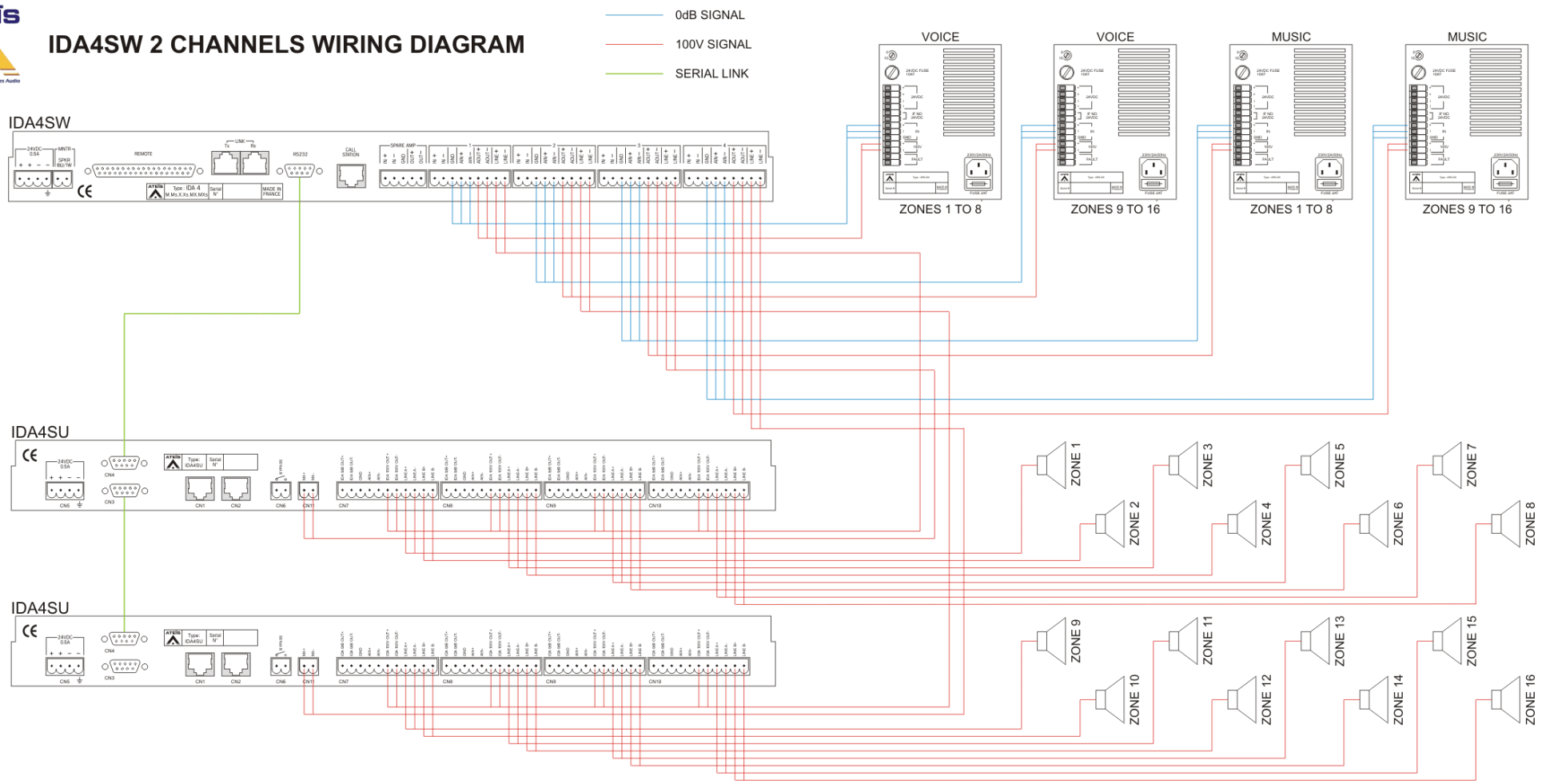
ZONE 30
ZONE 31
ZONE 32

IDA4SW 2 CHANNELS WIRING DIAGRAM



III. PA/VA system design rules with IDA4SW

a. Audio output Channel and Zone allocation

In switching application, you must be aware that the 8 zones of an IDA4SU are connected to a single audio output. Consequently only 1 announcement can be made at a time.

Audio routing is done at the channel-level, and zone-switching occurs only after, if the audio-source has the required priority.

Then if a new source with a higher priority takes the control of an audio channel, its zone-level routing will replace the current switching state.

You must consider this when allocating audio channels and zones in your system. Zones which can potentially be addressed by different sources at the same time must be placed on different audio channels.

Note that IDA4SW is very flexible. It is not compulsory to fill all channels with 8 zones, and you can connect any number of IDA4SU. Moreover, you still have the possibility to put a single zone with its own amplifier on a free channel without using an IDA4SU.

For example, you can build a 14 zones system with 2 IDA4SU on 1 IDA4SW:
5 zones on channel 1, 8 zones on channel 2 and 1 zone on channel 3.

b. Impedance error tolerance constraint

In switching application, with up to 8 lines on the same amplifier, you can have a lot of loudspeakers in parallel.
Detecting a cut line defect on only 1 line is therefore far more difficult because the error on this single line will translate into a little amount on the whole group of 8 lines in parallel.
So, on the one hand, we have to set a low tolerance threshold.

On the other hand, total line impedance is not perfectly stable because of the variation of temperature and pressure which typically causes fluctuations up to 5% on the impedance measure. So the tolerance threshold must be greater than 5%.

Consequently, you must make sure than a cut line defect on any line will cause an impedance error greater than 10%, by adding end of line capacitors on each line.

c. End of line capacitors for sufficient Impedance error

End of line capacitors are used to increase impedance error when the line is cut anywhere. When the capacitor is removed from the line, it will cause an additional error on the impedance measure.
By choosing a sufficient value, we can make sure that it will cause an error greater than the tolerance threshold.

We have the total loudspeakers impedance and 8 capacitors: $\frac{1}{Z} = \frac{1}{Z_{LINES}} + \frac{8}{Z_{CAPA}}$

If we lose a capacitor we have $\frac{1}{Z_E} = \frac{1}{Z_{LINES}} + \frac{7}{Z_{CAPA}}$

Relative error is $|e| = \frac{Z_E - Z}{Z} = 1 - \frac{8 \times Z_{LINES} + Z_{CAPA}}{7 \times Z_{LINES} + Z_{CAPA}} = \frac{Z_{LINES}}{7 \times Z_{LINES} + Z_{CAPA}}$

Capacitor impedance to achieve desired error is $Z_{CAPA} = \frac{(1 - 7e)}{e} \times Z_{LINES}$

Then we want $e > 10\%$, which leads to $Z_{CAPA} < 3 \times Z_{LINES}$

We have $Z = \frac{1}{C.2\pi f}$, which is applicable at frequency $f = 18\,\text{kHz}$

Finally the minimal capacitor than you must put on each line is $C = \frac{8841941}{3 \times Z_{LINES}}\, pF$.

d. Capacitors.xls

The supplied spreadsheet **Capacitors.xls** computes all for you.

What you have to do:

- measure the loudspeakers-only lines impedances with PCIDA4SW.
- put the values in the Excel file.
- supply the desired relative error.
- read the theoretical capacitor value.
- choose the nearest available value that fits your needs.
- add the capacitors at the end of the lines.
- make the lines references with PCIDA4SW.
- activate the monitoring on used channels

Finally, you must simulate an error by removing a capacitor to check your system

PCIDA4SW configuration tool

The PCIDA4SW software is almost identical to PCIDA4XM.
So, this manual will only highlight and explain news and differences in reference to PCIDA4XM. For further information, you should read “User manual IDA4XM V2.x”.

I. Presentation

The fundamental difference with (PC)IDA4XM is that we now differentiate ‘Zones’ and ‘Audio Channels’.

Here is how the labeling works in dual-channel mode:

IDASW	IDA4SU	Zones	Voice channel	Music channel
1	1	Z001-Z008	V002	M001
	2	Z009-Z016	V004	M003
2	3	Z017-Z024	V006	M005
	4	Z025-Z032	V008	M007
3	5	Z033-Z040	V010	M009
	6	Z041-Z048	V012	M011
4	7	Z049-Z056	V014	M013
	8	Z057-Z064	V016	M015

Here are the noticeable differences in PCIDA4SW:

1. Site General settings let you choose the mono-channel or dual-channel mode.

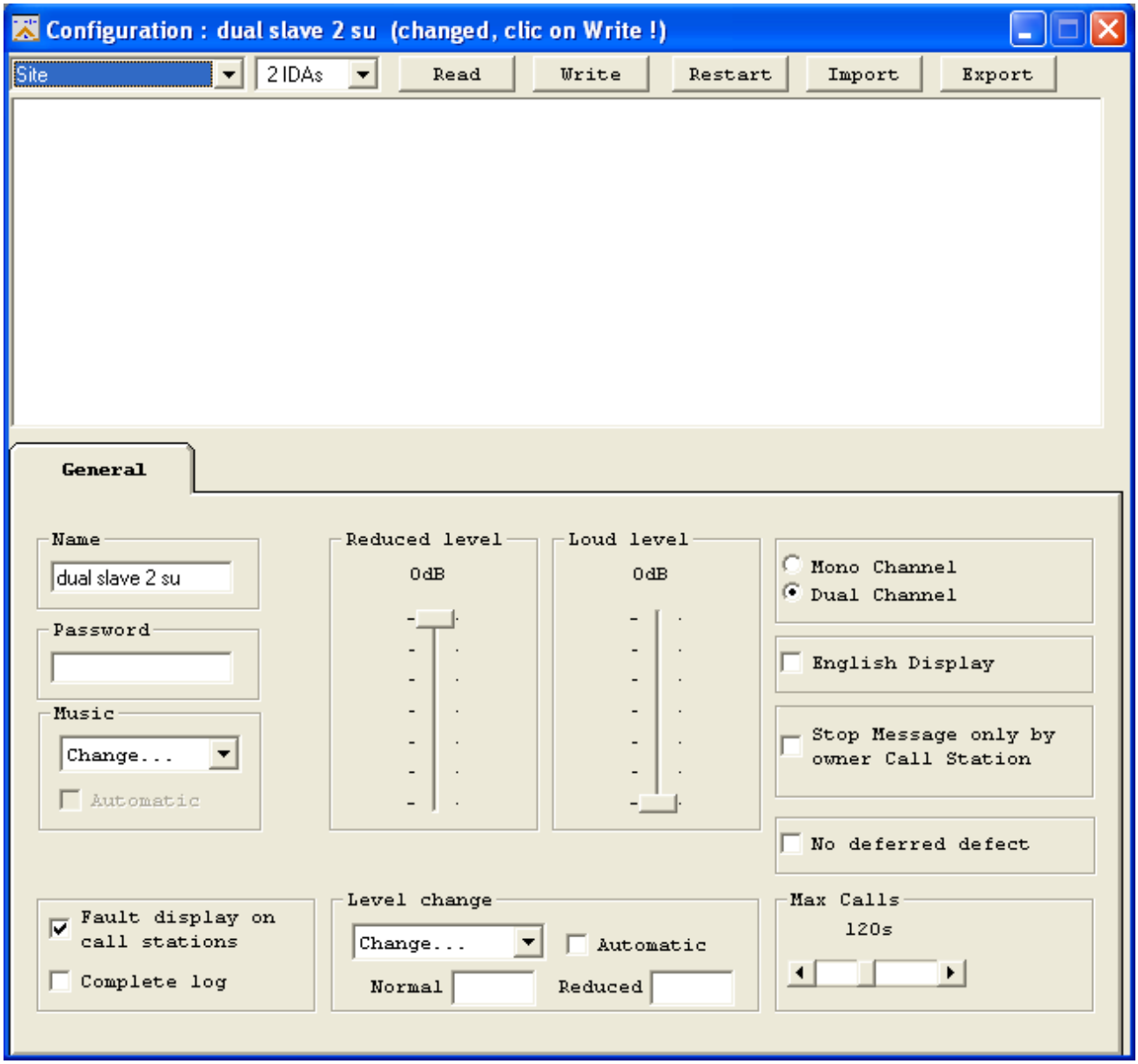
2. Zones settings let you choose the number of IDA4SU modules for each IDA4SW.
And there are now different names for channels and zones.

3. Monitoring settings have a global measure & reference for a channel, and 8 impedance references for the 8 zones of a channel.

4. Channel-level routing is used for audio settings (audio levels & eq)

5. Zone-level routing is used for all the rest.

II. SITE > GENERAL



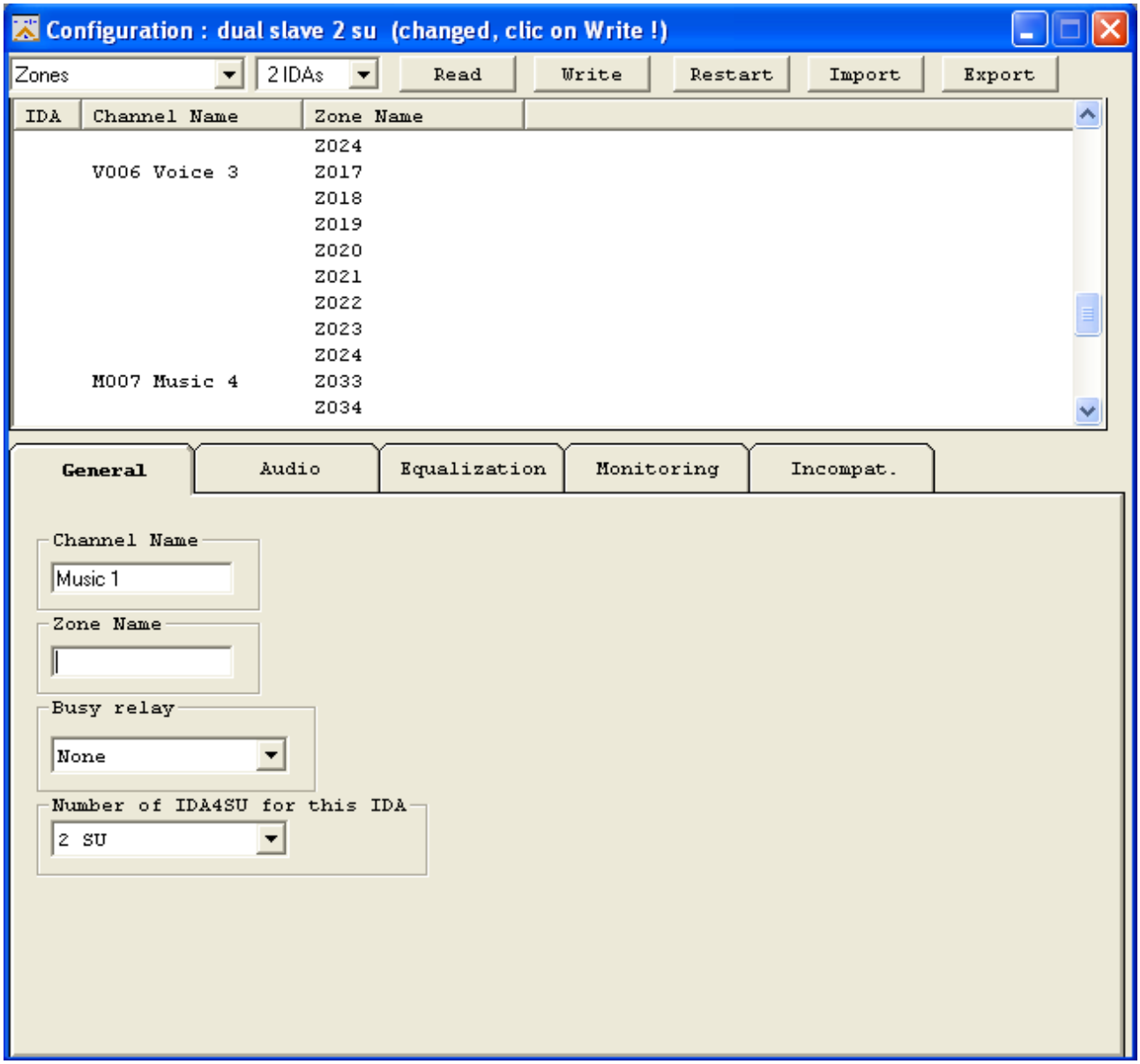
On PCIDA4SW, a checkbox let you choose between '**Mono-channel**' and '**Dual-channel**' modes.

III. ZONES

In mono-channel mode, you can use up to 4 audio channels (Vxxx), for up to 32 zones per IDA.

In dual-channel mode, a same group of 8 zones appear twice, on the voice channel and on the music channel. You can use up to 16 zones per IDASW.

a. ZONES > GENERAL



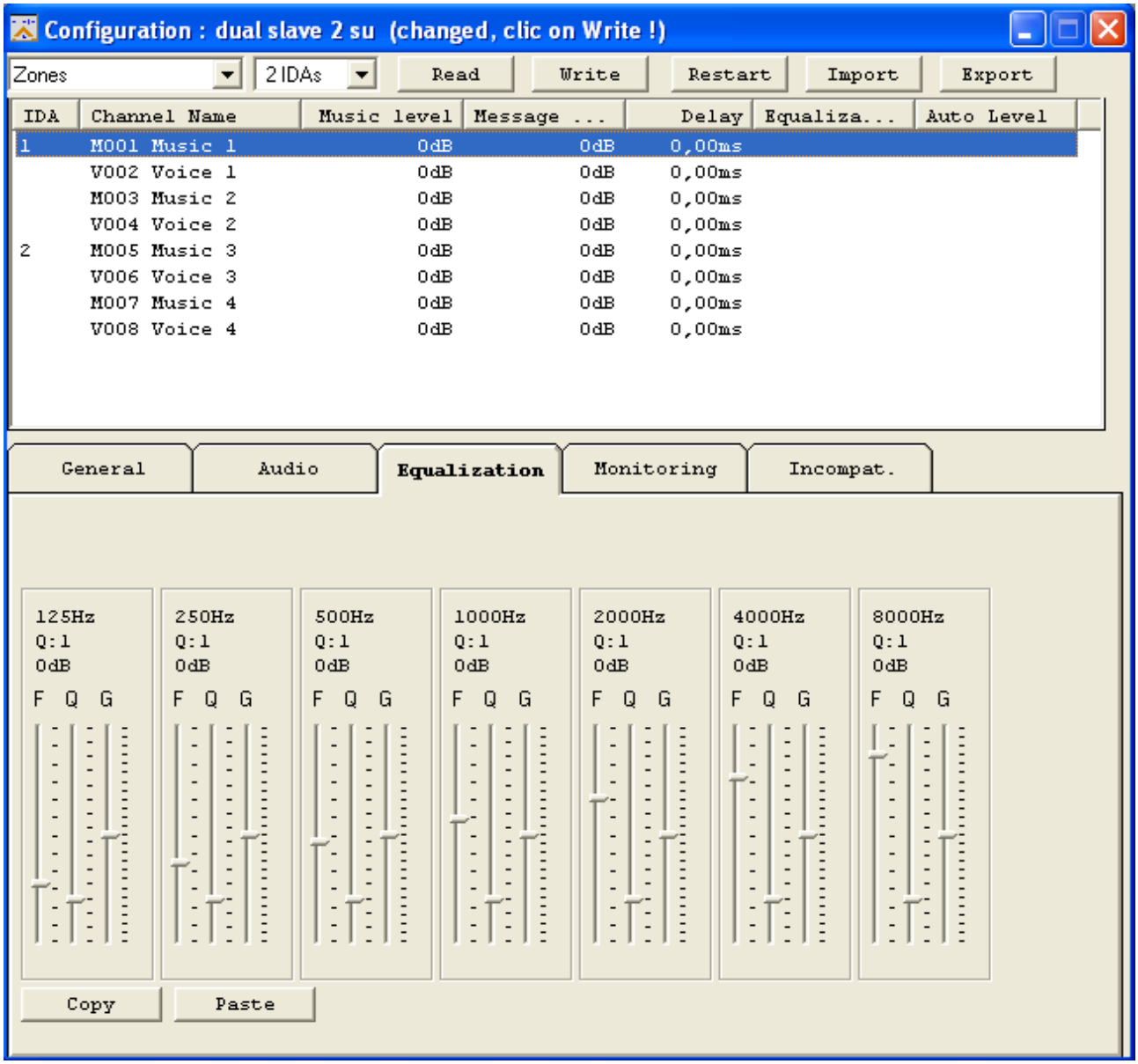
Channel Name and **Zone name**

There are now 2 separated text boxes (always 11 alphanum characters)
On the picture, it will apply to zone Z020 and channel V005 (for any zone from 17 to 24)

Number of IDA4SU for this IDA

This combo-box let you choose up to 4 IDA4SU in mono mode, and up to 2 in dual mode. On the picture, it will apply to IDA number 2 (for any selected zone from 17 to 32).

b. ZONES > AUDIO and EQUALIZATION



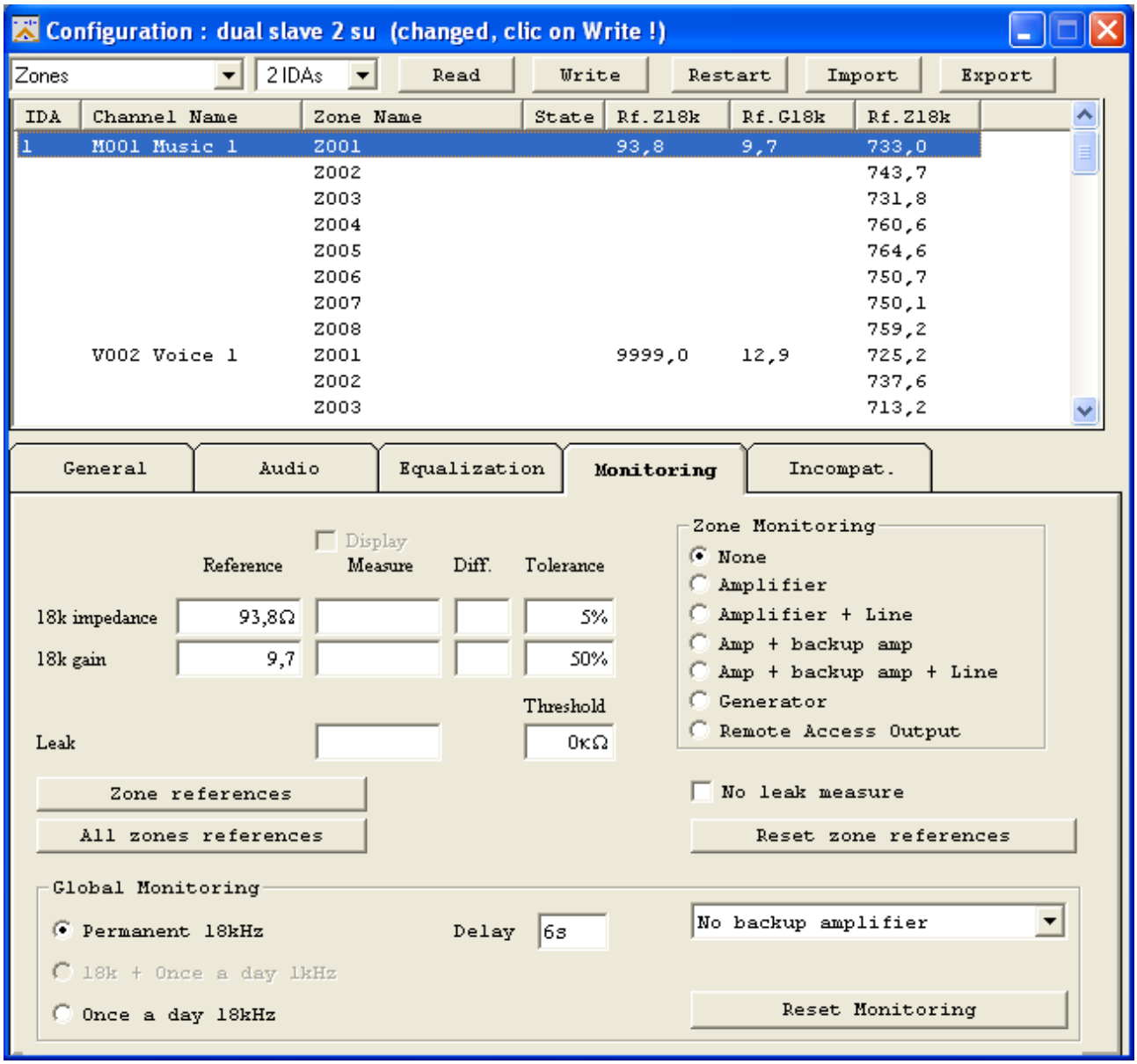
Audio and Equalization settings apply to **audio channels** and <u>not</u> to zones.

On the picture you can see that *Voice channels* are even channels of an IDA (V002, 004, 008, 008) and *Music channels* are odd (M001, 003, 005, 007).

Zones 1 to 8 are connected to V002 for the annoucements, and M001 for the music.

Zones 25 to 32 are connected to V008 for the annoucements, and M007 for the music.

c. ZONES > MONITORING



In the list, **Rf.G18k** displays only one amp gain value for the channel, while you have 8 **Rf.Z18k** impedance values for the 8 zones connected to that channel.

In the tab, values always concern the **audio channel**, and not the selected zone.

In dual-channel mode, **you must reference both** Voice channel **and** Music channel, because though it's the same lines, there can be differences in the measures (due to different amplifiers)

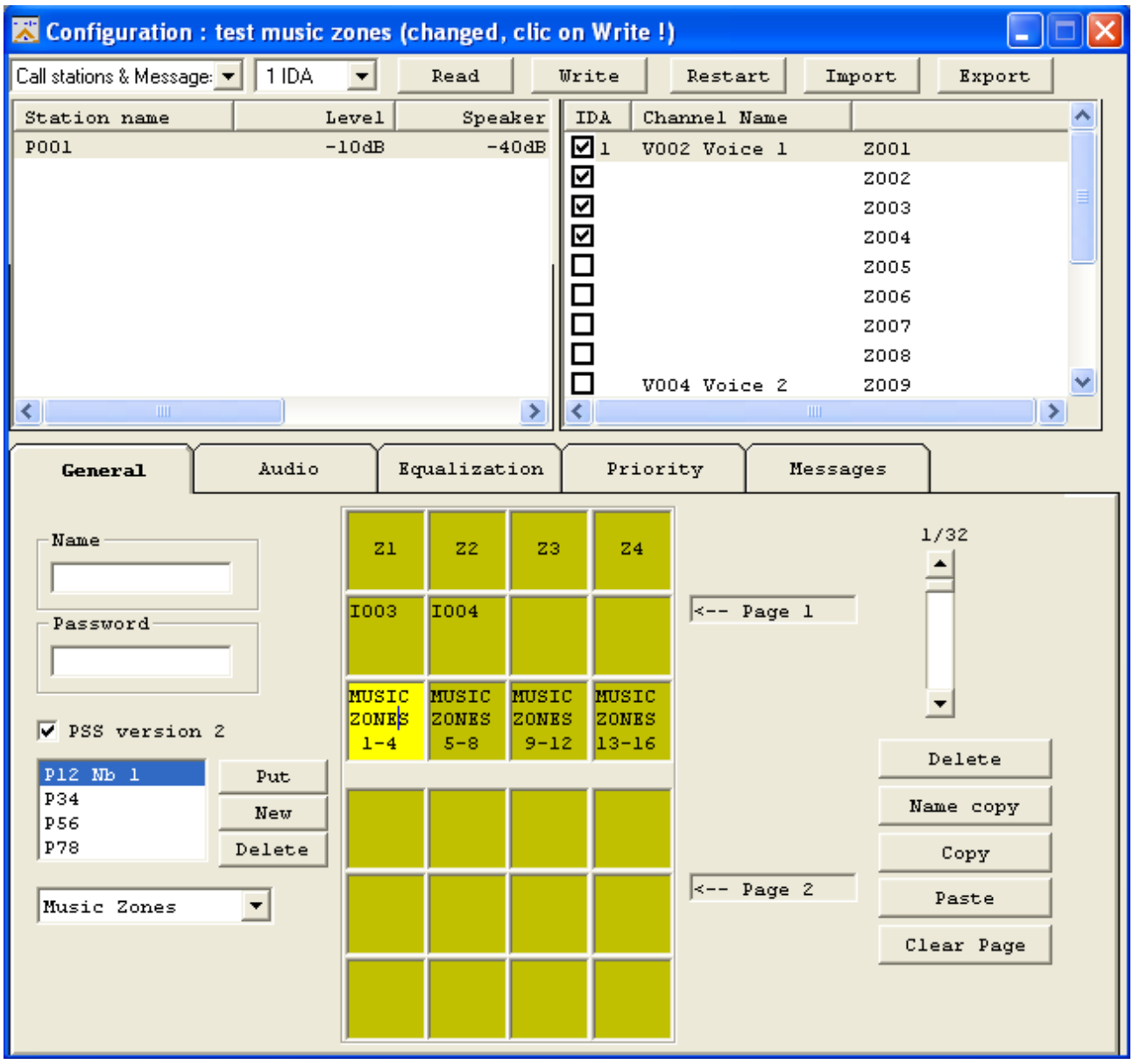
The **18k impedance Reference** is now measured with all working lines switched on. You can see the value is refreshed after a line defect.

On the picture, you can see 9999 Ω = 'open line' on the voice-channel, which is perfectly normal as the 8 zones are switched on the music-channel.

Note that there are no more 1K impedance and open gain measures/references.

IV. CALL STATIONS > GENERAL

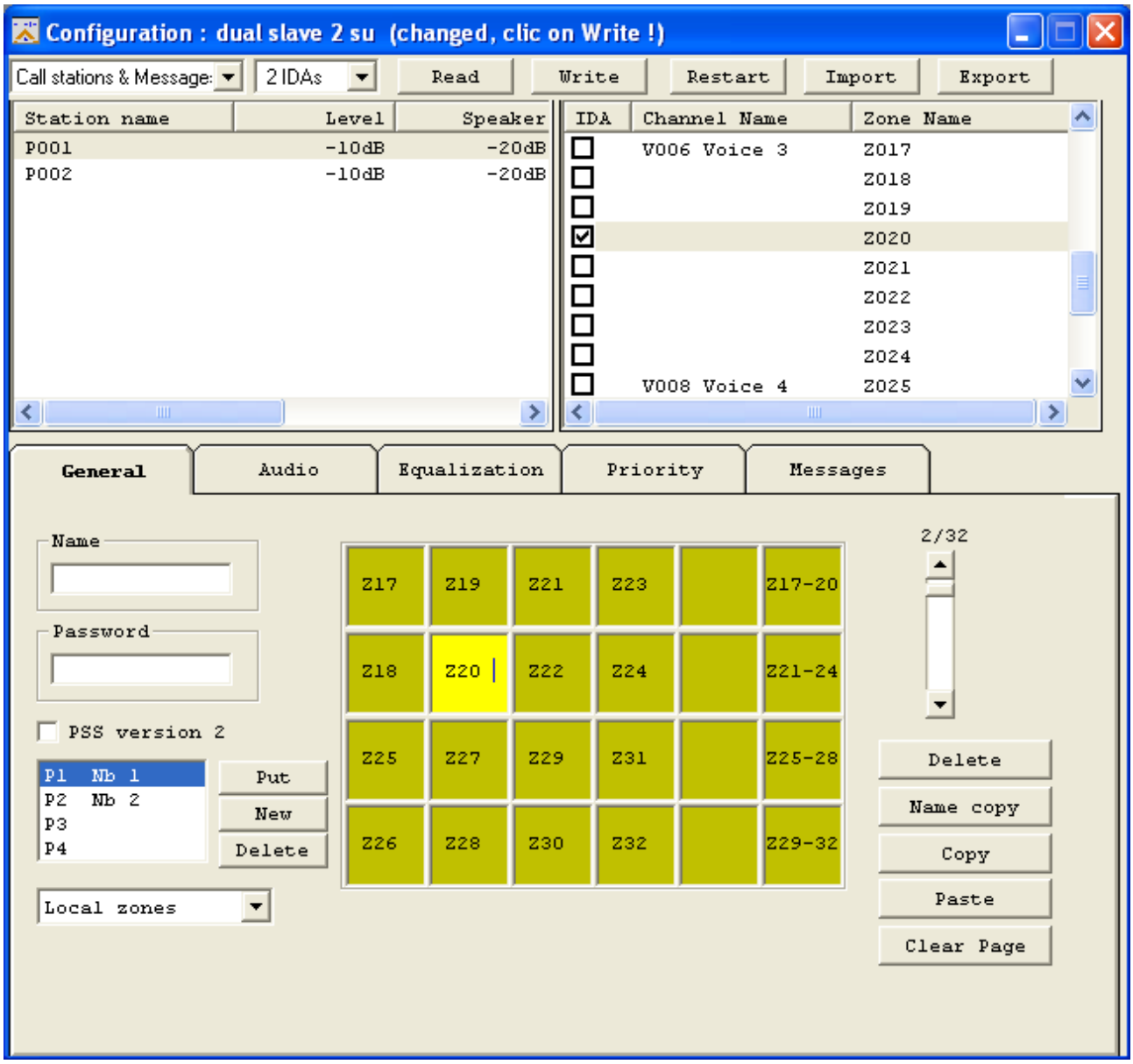
a. Music Zones



With IDA4SU v2, **Music zones** can now operate on **zones** (not limited to channels as SW 1.0.x)

In dual-channel mode, you can select only **voice channels**.

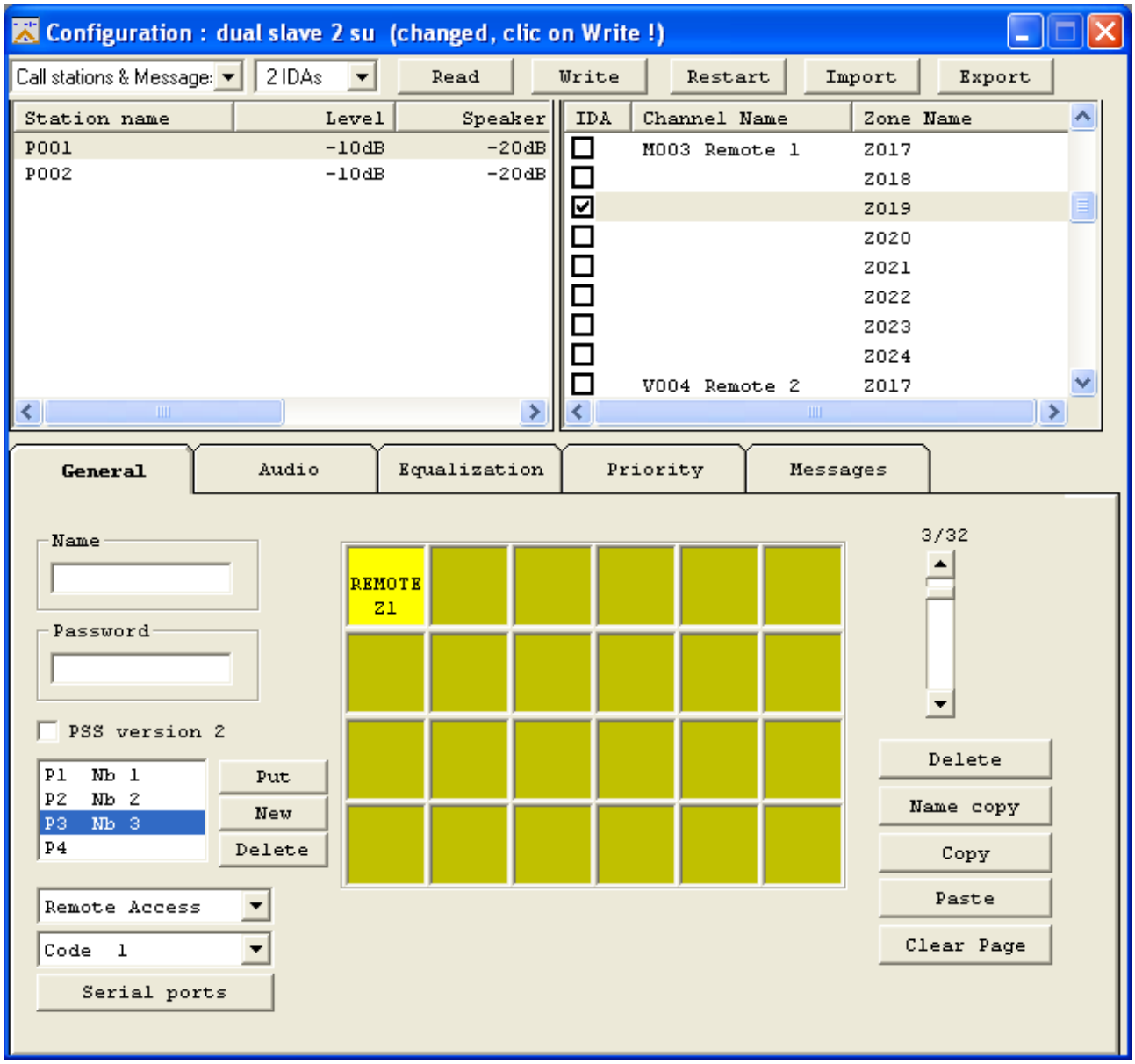
b. Local Zones / Mic-Chime Direct



Local PSS calls operate on **zones**.

In dual-channel mode, you can select only **voice channels**.

c. Remote Access

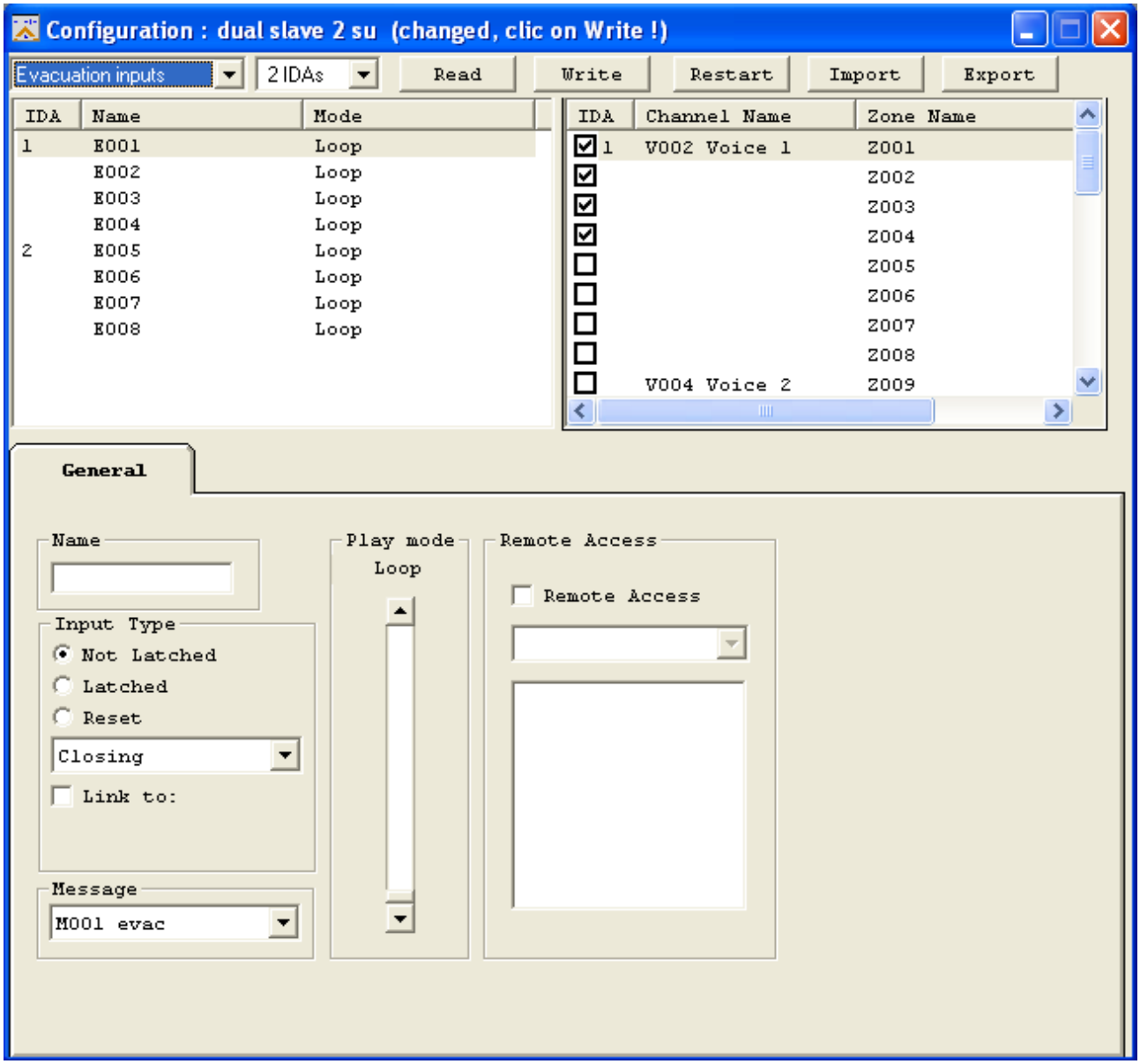


Remote Access is a special case. As IDA offers the possibility to address local zones while accessing remote zones, this key operates on **zones**.

But of course, the audio signal must be sent to remote zones via a **channel**.

Of course, there should not be any IDA4SU connected to this channel. You can select any zone from **any channel** you want to use (not limited to voice channels).

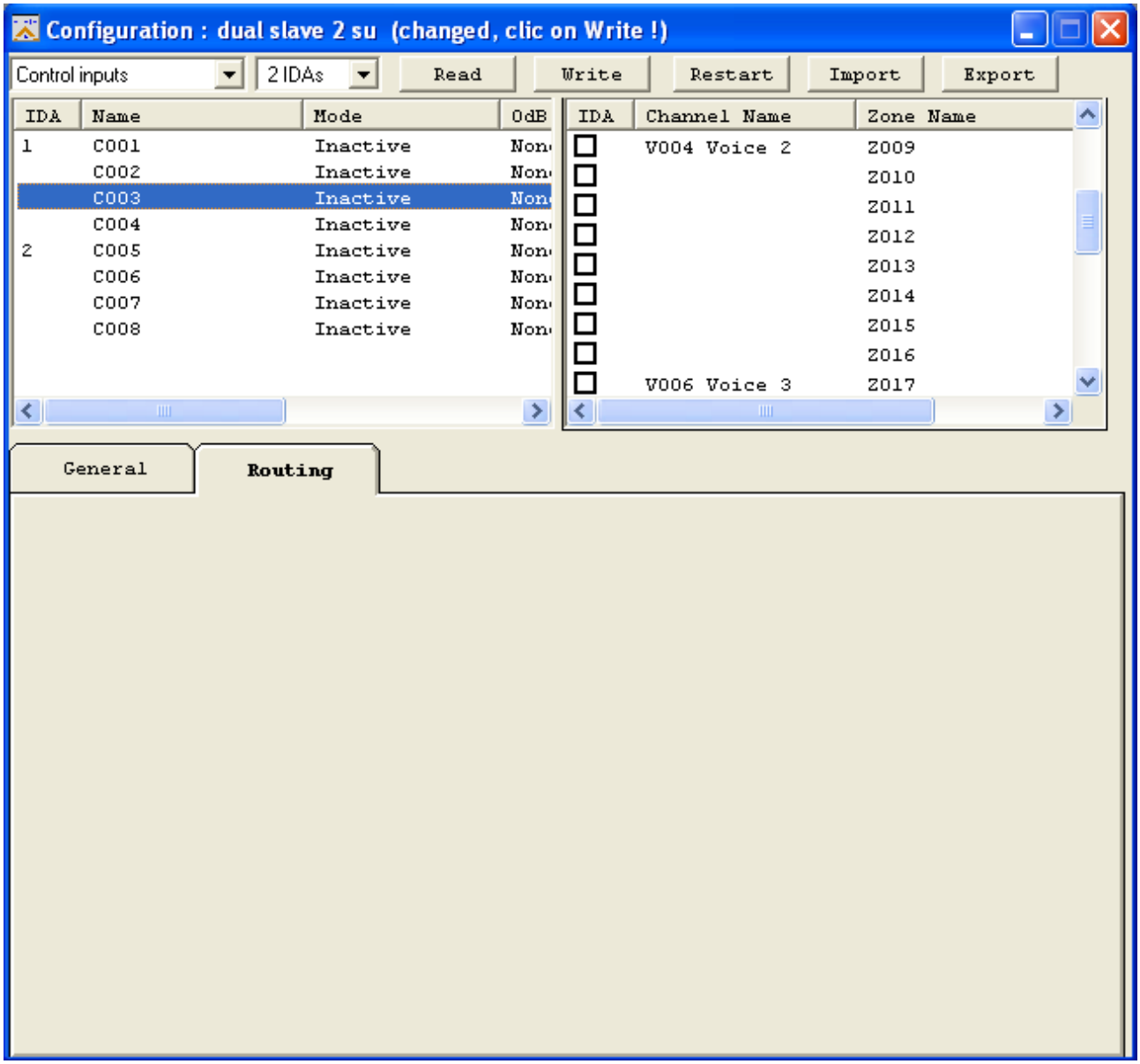
V. EVACUATION INPUTS



As expected, evacuation inputs routing operates on **zones from voice channels**.

In remote access case, you can also select music channels.

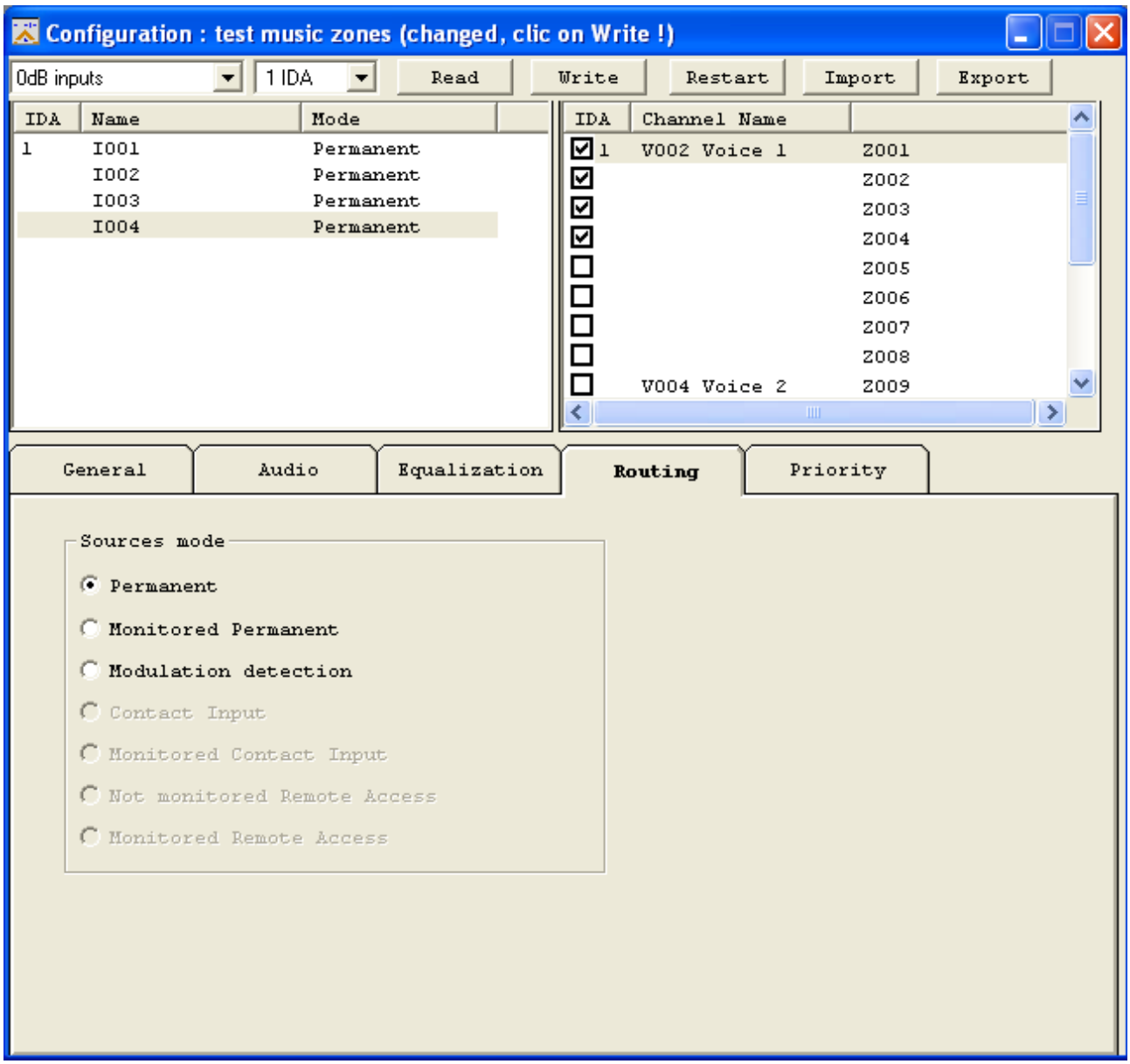
VI. CONTROL INPUTS > ROUTING



As expected, control inputs routing operates on **zones** (only from voice channels).

VII. 0dB INPUTS > ROUTING

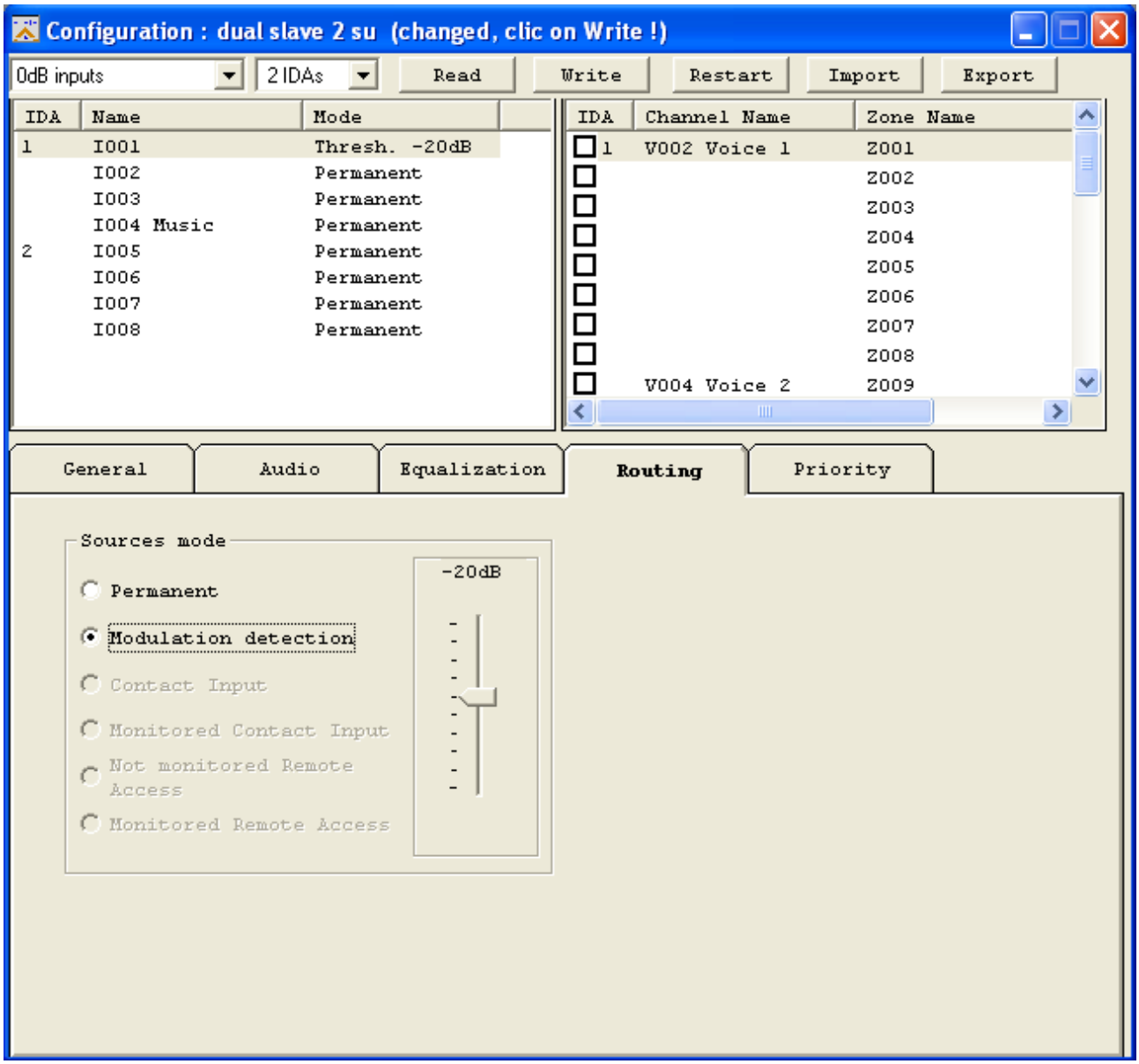
a. Permanent



With IDA4SU v2, **0dB input routing** can now operate on **zones** (not limited to channels as SW 1.0.x)

In dual-channel mode, you can select only **voice channels**.

b. Modulation detection



In **modulation detection** mode, 0dB inputs routing operates on **zones** (only from voice channels).

IDA4SW line-monitoring Tests

I. Functioning principle and possibilities

On IDA(x)(m)(s), the monitoring is made by measuring amp gain and line impedance regularly on monitored zones.

In switching application, the hardware is the same, then we have to keep in mind than it is operated on a channel basis and not on each zone. Consequently when a defect is detected on a channel, IDA4SW must use the SU to switch the 8 lines in order to detect which line(s) is (are) effectively defected.

Moreover, when a channel is used to make an announcement, we cannot perform monitoring at the zone level because it would involve switching the 8 lines and it is more important to still play the message in the usable lines than detect a defect on a zone. In this case, monitoring is done at the channel level only. The exception is a short-circuit, because there is no more signal in all zones.

a. Mono channel mode

In this mode, lines are switched on or off.

In background monitoring mode, all valid lines are switched on the surveillance signal (nothing or music + 18kHz oscillator).
When a line is short-circuited, it is switched off and isolated.

When an announce is made, only valid concerned zones are switched on.

b. Dual channel mode

In this mode, lines are switched either on the music channel or on the voice channel.

In background monitoring mode, all valid lines are switched on the music channel.
Zone monitoring is done on the music channel, consequently the voice channel is not connected, and we cannot detect the Open Circuit defect on voice channels (only Short Circuit)
When a line is short-circuited, it is switched on the voice channel which is monitored too for channel-level surveillance. Consequently, we can also detect when a defected line is back.

When an announce is made, only valid concerned zones are switched on the voice channel. Other lines and defected ones are switched on the music channel. Consequently:

- if a line is short-circuited, music will be cut for other lines
- if all lines play the voice message, we cannot detect the Open Circuit defect on the music channel anymore.

II. Tests in background monitoring mode

a. Zone defects BEGINNING detection

Defect	Conformity	Comments
Open Circuit	**OK**	
Short Circuit	**OK**	
Impedance	**OK**	

b. Zone defects END detection

Defect	Conformity	Comments
Open Circuit	**OK**	
Short Circuit	**OK**	**N/A in mono-channel mode**
Impedance	**OK**	

c. Channel defects detection in mono-channel mode

Defect	Conformity	Comments
Open Circuit	**OK**	
Short Circuit	**OK**	

d. Channel defects detection in dual-channel mode

Defect	Conformity	Comments
Voice channel Open Circuit		**N/A**
Voice channel Short Circuit	**OK**	
Music channel Open Circuit	**OK**	
Music channel Short Circuit	**OK**	

III. Tests while announces

a. Zone defects BEGINNING detection

Defect	Conformity	Comments
Open Circuit Or Impedance		**N/A (no switching during announce)**
Short Circuit Mono mode	**OK**	**only on announcing lines**
Short Circuit In Voice channel	**OK**	
Short Circuit In Music channel	**OK**	**-> global channel defect (no switching)**

b. Channel defects detection in mono-channel mode

Defect	Conformity	Comments
Open Circuit	**OK**	**Rare exception if there are only OC lines announcing**
Short Circuit	**OK**	

c. Channel defects detection in dual-channel mode

Defect	Conformity	Comments
Voice channel Open Circuit	**OK**	**Rare exception if there are only OC lines announcing**
Voice channel Short Circuit	**OK**	
Music channel Open Circuit	**OK**	**Exception if there are only OC lines or no line at all which are NOT announcing**
Music channel Short Circuit	**OK**	**can mask a SC line (no switching)**